

What Is Claimed:

1. A cracking catalyst composition capable of being maintained within a fluid cracking catalyst unit used in cracking hydrocarbon feedstock containing organic sulfur-containing compounds, the cracking catalyst composition comprising

- (a) zeolite ; and
- (b) Lewis Acid-containing component

wherein the cracking catalyst composition further comprises 0.20 percent by weight Na_2O or less.

2. The composition of Claim 1 wherein the composition comprises 0.15 percent by weight Na_2O or less.

3. The composition of Claim 1 wherein the composition comprises 0.10 percent by weight Na_2O or less.

4. The composition of Claim 1 wherein the zeolite (a) comprises 0.5 percent by weight Na_2O or less.

5. The composition of Claim 1 wherein the zeolite (a) comprises 0.3 percent by weight Na_2O or less.

6. The composition of Claim 1 wherein the zeolite (a) comprises 0.1 percent by weight Na_2O or less.

7. The composition of Claim 1 wherein the Lewis Acid-containing component (b) comprises 0.1 percent by weight Na_2O or less.

8. The composition of Claim 1 wherein the zeolite is a Y-type zeolite selected from the group consisting of HY, USY, REY, REUSY, CREY, CREUSY, MgUSY, ZnUSY, MnUSY-type zeolites and mixtures thereof.

9. The composition of Claim 1 wherein the zeolite is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.
10. The composition of Claim 2 wherein the zeolite is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.
11. The composition of Claim 4 wherein the zeolite is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.
12. The composition of Claim 5 wherein the zeolite is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.
13. The composition of Claim 1 wherein the zeolite has an average unit cell size of from about 24.25 to 24.50Å.
14. The composition of Claim 1 wherein the zeolite has an average unit cell size of from about 24.5 to 24.7Å.
15. The composition of Claim 1 wherein the Lewis Acid-containing component (b) comprises alumina.
16. The composition of Claim 1, wherein the Lewis Acid-containing component (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.
17. The composition of Claim 1 wherein the Lewis Acid-containing component (b) has a metal selected from the group consisting of Zn, Ti, Co, Mo, Fe and mixtures thereof, wherein said metal is present as an oxide, as a cation or is in its zero valence state.

18. The composition of Claim 15 wherein the metal of the Lewis Acid-containing component (b) further comprises Zn.
19. The composition of Claim 2, wherein the Lewis Acid-containing component (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.
20. The composition of Claim 2 wherein the Lewis Acid-containing component (b) has a metal selected from the group consisting of Zn, Ti, Co, Mo, Fe and mixtures thereof, wherein said metal is present as an oxide, as a cation or is in its zero valence state.
21. The composition of Claim 2 wherein the metal of the Lewis Acid-containing component (b) comprises Zn.
22. The composition of Claim 7, wherein the Lewis Acid-containing component (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.
23. The composition of Claim 15 wherein the alumina has a particle size of from 20 to 150 μ and a surface area of from 30 to 400 m²/g.
24. The composition of Claim 15 wherein the zeolite (a) further contains rare earth.
25. The composition of Claim 1 wherein the composition comprises at least 3% by weight Lewis Acid-containing component (b).
26. The composition of Claim 25 wherein the Lewis Acid-containing component (b) is a Lewis Acid metal cation exchanged on zeolite (a).

27. The composition of Claim 1 wherein the composition comprises from about 3 to about 75 weight percent of component (b).
28. The composition of Claim 1 wherein the composition comprises 30 to 75 weight percent of component (b).
29. The composition of Claim 27 wherein zeolite (a) is a Y-type zeolite having a sodium content of 0.3% by weight Na_2O or less, and the composition has a kinetic conversion activity of at least about 2.
30. The composition of Claim 1 further comprising inorganic oxide matrix (c).
31. The composition of Claim 30 wherein the composition comprises a blend of least two separate particles, one particle comprising zeolite (a) and inorganic oxide matrix (c) and the other particle comprising Lewis Acid-containing component (b).
32. The composition of Claim 31 wherein the Lewis Acid-containing component (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.
33. The composition according to Claim 32 wherein the composition comprises 0.15% by weight Na_2O or less.
34. The composition according to Claim 32 wherein the zeolite (a) comprises 0.3% by weight Na_2O or less.
35. The composition according to Claim 32 wherein the Lewis Acid-containing component comprises 0.10% by weight Na_2O or less.
36. The composition according to Claim 34 wherein the composition comprises 0.15% by weight Na_2O or less.

37. The composition of Claim 31 wherein Lewis Acid-containing component (b) comprises alumina and Zn, wherein said Zn is present as an oxide or is in its zero valence state.
38. The composition of Claim 31 wherein the composition has a kinetic conversion activity of at least about 2.
39. The composition of Claim 32 wherein the composition has a kinetic conversion activity of at least about 2.
40. The composition of Claim 1 further comprising vanadium.
41. The composition of Claim 31 further comprising vanadium.
42. The composition of Claim 32 further comprising vanadium.
43. The composition of Claim 1 where in the average particle size of the composition is in the range of 20 to 150 microns.
44. The composition of Claim 1 where in the average particle size of the composition is in the range of 60 to 90 microns.

45. An improved process for catalytic cracking of hydrocarbon feedstock which contains organic sulfur compounds comprising contacting in a catalytic cracking reactor of a fluid catalyst cracking unit an inventory of fluid cracking catalyst composition, removing the liquid and gaseous product streams from said reactor, transferring a portion of the inventory to regenerators of said unit to remove contaminants before returning same to the reactor, removing a portion of the inventory from the unit while replacing same with fresh catalyst composition to provide an equilibrium state of said inventory, the improvement comprising (1) adding to the inventory of fluid cracking catalyst composition in the unit a fresh cracking catalyst composition comprising (a) zeolite, and (b) Lewis Acid-containing component, wherein the cracking catalyst composition further comprises 0.20 percent by weight Na_2O or less, and (2) recovering a liquid product having a boiling point of up to about 220°C , said liquid product having a sulfur content that is at least 15 weight percent lower than that attained by a composition composed of the same zeolite catalyst without Lewis Acid-containing component (b).

46. An improved process according to Claim 45 wherein the fresh cracking catalyst composition comprises a catalyst according to any one of claims 2-

47. An improved process according to claim 46 wherein said liquid product has a sulfur content that is at least 20% percent lower than that attained by a composition composed of the same zeolite catalyst without Lewis Acid-containing component (b).

48. A method of reducing sulfur in gasoline originating from a naphtha stream generated by a fluidized catalytic cracking (FCC) unit having a reaction stage and a regeneration stage process, the method comprising:

- (a) preparing a cracking catalyst composition comprising zeolite and Lewis Acid-containing component wherein the cracking catalyst composition further comprises 0.20 percent by weight Na_2O or less;
- (b) adding the catalyst composition to a catalyst inventory of the FCC unit;
- (c) introducing the catalyst composition to the reaction stage of the FCC unit in amounts sufficient to convert hydrocarbon feed entering the reaction stage of the FCC unit into hydrocarbon products having a sulfur content of at least 15% less than that produced when using a catalyst composition without said Lewis Acid-containing component; and
- (d) recycling the catalyst inventory from (c) to the regeneration stage of the FCC unit to remove coke from the catalyst inventory.

49. A method according to Claim 48 wherein the cracking catalyst composition comprises a metal selected from the group consisting of Zn, Ti, Co, Mo, Fe, and mixtures thereof, wherein said metal is present as an oxide, as a cation or is in its zero valence state.

50. A method according to Claim 49 wherein the metal is Zn.

51. A method according to Claim 48 wherein the Lewis Acid component comprises alumina.

52. A method for making a cracking catalyst composition capable of being maintained within a fluid cracking catalyst unit used in cracking hydrocarbon feedstock, the method for making the catalyst comprising:

- (a) selecting a zeolite comprising about 0.5 percent by weight Na_2O or less,
- (b) selecting a Lewis Acid-containing component comprising about 0.1 percent Na_2O or less, and
- (c) combining said zeolite and Lewis Acid-containing component in proportions sufficient to produce a catalyst composition that comprises about 0.2 percent by weight Na_2O or less.

53. The method of Claim 52 wherein the catalyst composition produced in (c) comprises 0.15 percent by weight Na_2O or less.

54. The method of Claim 52 wherein the catalyst composition produced in (c) comprises 0.10 percent by weight Na_2O or less.

55. The method of Claim 52 wherein the zeolite selected in (a) comprises 0.3 percent by weight Na_2O or less.

56. The method of Claim 52 wherein the zeolite selected in (a) comprises 0.1 percent by weight Na_2O or less.

57. The method of Claim 52 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of HY, USY, REY, REUSY, CREY, CREUSY, MgUSY, ZnUSY, MnUSY-type zeolites and mixtures thereof.

58. The method of Claim 52 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.

59. The method of Claim 53 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.

60. The method of Claim 54 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.

61. The method of Claim 55 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.

62. The method of Claim 56 wherein the zeolite selected in (a) is a Y-type zeolite selected from the group consisting of USY, REY, REUSY, CREY, CREUSY and mixtures thereof.

63. The method of Claim 52, wherein the Lewis Acid-containing component selected in (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.

64. The method of Claim 52 wherein the Lewis Acid-containing component selected in (b) comprises a metal selected from the group consisting of Zn, Ti, Co, Mo, Fe and mixtures thereof, wherein said metal is present as an oxide, as a cation or is in its zero valence state.

65. The method of Claim 54, wherein the Lewis Acid-containing component selected in (b) comprises alumina and at least one metal selected from the group consisting of Ni, Cu, Zn, Ag, Cd, In, Sn, Hg, Ti, Pb, Bi, B, Mn, Ga and mixtures thereof, wherein said at least one metal is present as an oxide, as a cation or is in its zero valence state.

66. The method of Claim 54 wherein the Lewis Acid-containing component selected in (b) comprises a metal selected from the group consisting of Zn, Ti, Co, Mo, Fe and mixtures thereof, wherein said metal is present as an oxide, as a cation or is in its zero valence state.

67. The method of Claim 52, wherein the catalyst composition produced in (c) comprises at least about 3% by weight of Lewis Acid-containing component selected in (b).

68. The method of Claim 67 wherein the Lewis Acid-containing component is a metal cation produced during an exchange reaction with the zeolite.

69. The method of Claim 52 wherein the catalyst composition produced in (c) comprises from about 3 to about 75 weight percent of Lewis Acid-containing component selected in (b).

70. The method of Claim 52 wherein the catalyst composition produced in (c) comprises 30 to 75 weight percent of Lewis Acid-containing component selected in (b).

71. The method of Claim 67 wherein zeolite selected in (a) is a Y-type zeolite having a sodium content of 0.3% by weight Na_2O or less, and the catalyst composition produced in (c) has a kinetic conversion activity of at least about 2.